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Rayleigh-Taylor experiments on the Linear Electric Motor

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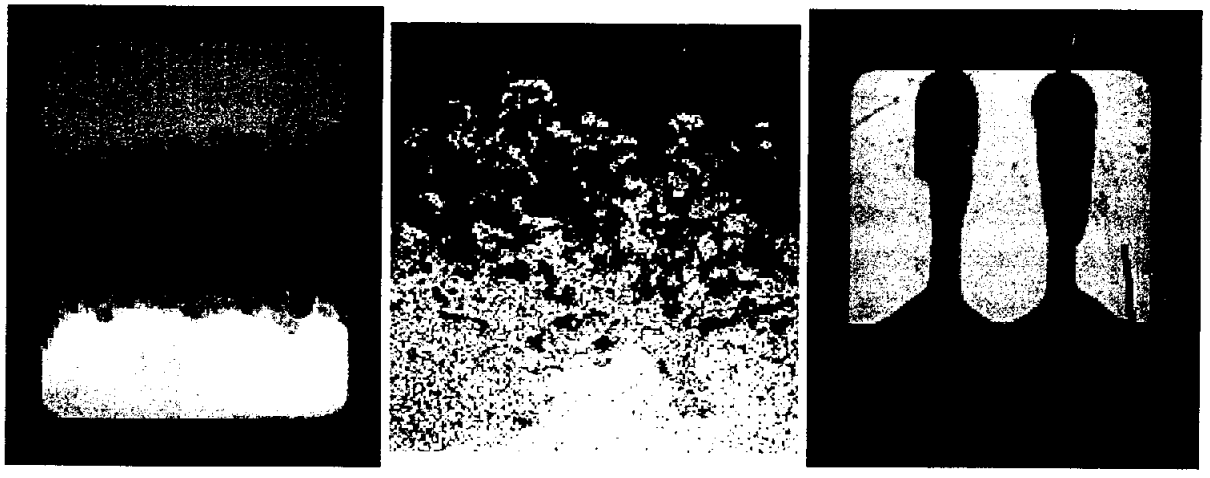
Rayleigh-Taylor (RT) instability experiments are conducted on the Linear Electric Motor (LEM)[1] with arbitrary temporal acceleration profiles g(t). The LEM has a rail gun type configuration, but the reliability and velocities of an electric motor. Variable g(t) profiles are obtained by 16 independent circuits with electrolytic capacitors (5.6 f). The projectile has a fluid volume of ~ 1 liter and a total mass of ~ 2 kg.

Turbulent RT experiments are conducted with high Reynolds number fluids over a variety of Atwood numbers. The width and structure of the mixing zone is diagnosed with backlit photography and laser induced fluoresence (LIF). The bubble and spike penetration obeys the familiar gt^2 scaling for a constant acceleration [2] and a power law scaling t^θ for an impulsive acceleration [3]. Four g(t) profiles are investigated [1].



Photography **LIF** **RT with strength**

The RT instability is also studied in materials with strength using Bingham plastics, such as yogurt. For small amplitude, the finite yield strength inhibits the instability. The instability grows when the initial amplitude exceeds a critical amplitude, which depends on the perturbation wavelength and the material properties and dimensions. The results are compared to theory[4] and simulations in both 2D and 3D.

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